Forest Improvement Handbook

Stewardship for Tomorrow

Indiana Department of Natural Resources
Division of Forestry

Forest Improvement

Healthy forests across the United States have the distinction of being able to provide countless benefits for private landowners. Among these benefits are the aesthetic beauty of a healthy forest, watershed protection, wildlife habitat, and timber resources. However, many forests suffer the abuses of livestock grazing, fires, insect and disease attacks and natural overcrowding. By using methods of forest improvement, a forest will become more healthy and productive, and can meet the land use objectives and needs of the private landowner.

Forest improvement involves providing necessary growing space for high quality trees and creating an environment for the natural reseeding of the forest. Productivity, wildlife habitat, recreation, water quality and other environmental conditions are all taken into consideration.

Woodland Goals Through Improvement

Protection

For forest improvement to be successful, the woods must be protected from livestock grazing and fire. Grazing reduces soil quality because livestock compact the soil on the forest floor. Compaction prevents feeder roots from getting necessary air supplies through the soil, and allows organic mulch to be washed away by water before the nutrients can be absorbed into the soil.

Wildlife

Forest improvement helps create diverse wildlife habitat. Woodland openings for natural reseeding can attract wildlife such as deer and songbirds that thrive near edges where open areas and woodlands meet. Thinning to release crop trees provides nesting cavities for woodpeckers, owls, squirrels and other wildlife species.

Recreation

Healthy, productive woodlands provide valuable intrinsic qualities for the forest land owner. Birdwatching, hiking and hunting are just a few of the recreational opportunities a healthy forest can provide.

Timber Production

When efforts are made to improve a forest, time between timber harvests is reduced, growth rates of high-value trees increase, and the species composition of the forest can be improved to include desired species of trees.

Improvement Methods

Selecting the Best Sites

The forest landowner and a professional forester should first identify sites with the best potential for improvement. In northern Indiana's gently rolling, glaciated soils, productive forest sites can exist almost anywhere. In southern Indiana, north and northeast facing slopes, cove areas and creek bottoms generally offer the best potential and normally contain fertile soils. Such areas, protected from direct sunlight and wind, contain more moisture and nutrients for tree growth.

Recently harvested sites should be given top priority for forest improvement. Landowners use improvement after a harvest to complete openings for regeneration of future crop trees. Improvement eliminates vines and trees of low quality to give crop trees growing space. Forest improvement immediately increases the quality of the remaining stand after a timber harvest, and encourages desirable tree regeneration in forest openings.

Crop Tree Release

This practice promotes increased growth of the best trees in the stand by removing adjacent, competing, less desirable trees. It is most important in black walnut and quality oak, ash and cherry stands.

In releasing a crop tree, any tree or vine that is competing with the crop trees' crown for sunlight should be eliminated. This will allow the crop tree to develop a full, vigorous crown necessary for maximum growth. A good crop tree is:

1. healthy and vigorous
2. a desirable species suited to that site (soil type and slope characteristics determine suitability)
3. generally straight with no forks in the trunk
4. in a dominant or co-dominant position in the canopy (A dominant position means the trees' crown is above surrounding crowns and can receive full sunlight on all sides. A co-dominant position means the tree's crown is in the upper canopy and at the same level as adjacent trees. The top of the crown receives full sunlight.)

Thinning

SAPLING-SIZED STANDS, less than 6" diameter

These stands are usually well stocked or overstocked. Future crop trees have usually asserted their dominance in the stand, but growth will begin to slow without some crown release. Future crop trees should be selected and released by deadening trees or vines that interfere with the crop trees' crown. Select crop trees on a 12'-15' spacing.

POLE-SIZED STANDS, 6"-12" in diameter

A well-managed forest should have at least 25 to 30 crop trees per acre at final harvest. However, during the life of the forest, some natural mortality will occur through disease attacks, lightning, windstorms, etc. Some trees should be harvested in intermediate cuttings. Therefore, in a post and pole sized stand, select about 60 crop trees per acre. A general spacing guide is 25'-30' between trees.

CAUTION: A common mistake in releasing crop trees in pole sized stands is over-release of crop trees. Over-release, or providing too much space between trees, eliminates healthy competition between trees. In over-release, trees are no longer trained to grow long, straight trunks to get their share of sunlight. Rather, branches will remain lower in the trunk. This produces more blemishes in the wood and results in a loss of timber value.

Eliminating Wild Grapevine Competition

Grapevines often grow through and over the tops of trees, and can kill or deform trees. It is desirable to kill or deaden all wild grapevines in areas where there are many high-quality stems, and in areas to be opened up by a regeneration harvest. Vine removal should precede a timber harvest by 3-5 years.

If the forest floor is heavily shaded, grapevines need only be cut off at any convenient height. If there will be a timber harvest within two growing seasons, or if the sun shines on the forest floor most of the day, then grapevines and vine loops should be cut and treated near the soil level with an appropriate herbicide. Sometimes vines are cut near the soil surface and at waist level, so the people doing the work can tell by the swinging end that the vine was cut.

When sap is flowing out of cut vines, the appropriate herbicide treatment will be the "basal treatment" on the herbicide label. The bark of the vine stump is soaked with herbicide, which is usually mixed with oil or diesel fuel.

Vines do not have to be eliminated from a forest. In the case of vine tangles or concentrations, control of the tangle itself is not physically feasible due to the large number of vines and the presence of thousands of grape seeds in the soil. Control of the vines up to the area of the tangle is usually possible.

▼ *Grapevines will seriously damage or kill a tree*

NOTE: Vines that develop rootlets (hairs) that fasten to tree trunks are not grape, and do not need to be removed because they do not grow over the top of tree leaves and branches. These vines are often poison ivy and wood vine, and are valuable for beauty, wildlife food, and nesting places.

Cull Tree Removal

Areas that contain wolf trees, culls and badly damaged trees occupy space that younger, vigorous and potentially valuable trees can use. A "wolf tree" is a tree with a large crown and short trunk, and probably developed when it had little or no competition from other tree crowns while it matured. A "cull tree" has no commercial value, but it may provide wildlife food, breeding or nesting sites.

Improvement Mechanics

Cutting

Cut the trees if the work will pay for itself by producing posts, firewood, or other useful products. Cutting large wolf trees or cull trees is rarely feasible; it often results in damage to remaining nearby trees and can be dangerous to the sawyer. These trees should be girdled or frilled.

It is a good practice to kill the stumps of smaller trees by chemical means to prevent sprouting. Small stumps of desirable species such as oak, ash, and tuliptree should be cut low to the ground and left untreated since sprouts from these stumps may become a crop tree in the next stand.

Girdling

Girdling is the removal of a section of bark and cambium layer all around the tree with either an axe or chainsaw. The ring must connect at both ends, for any uncut portion will continue to supply nutrients to the tree and the tree might survive. Girdling can be effective if a cut is carefully made completely around the tree and deeply enough to get into the wood. Chainsaw girdles are more effective if two cuts are made around the tree about 6" apart and 3/4" deep. Axe girdles can be made by cutting a 4" wide ring of bark and cambium. Killing the tree and leaving it standing allows the tree to deteriorate gradually, therefore doing little damage to the surrounding trees as it breaks up. The best time to girdle is in late summer or early fall, although it can be done during other seasons. Applying an appropriate herbicide into one of the girdles will ensure an effective kill. Be sure to apply the herbicide into the girdle cut completely around the tree.

▼ *The aspen on the left has been girdled with an axe. This will allow the tulip tree on the right to continue growing vigorously.*

The disadvantages of girdling without herbicides are that unwanted sprouting may occur, and girdling is usually not effective on trees with stump wounds or seams where ingrown bark occurs.
(CAUTION: Small diameter, hollow and defective trees can snap when using chainsaws in girdling. Large, hollow beech trees are also potential hazards. When a tree appears hollow, use an axe for girdling.)

Frilling

This is the best method to kill trees over 4" in diameter. A frill girdle is made by cutting around the trunk with an axe at a downward angle, creating a "frilly" appearance, or by making a single chainsaw cut around the tree. Frilling forms pockets where herbicide can be easily applied. If the tree has wounds or seams involving ingrown bark, the frills should be made above the defect. A herbicide appropriate for use with frilling is applied to the freshly cut frill until all surfaces are wet

Basal Spraying

Basal spraying may be used to effectively kill a tree less than 4" in diameter. The herbicide appropriate for this use should be directed at the base of the trunk or stem to saturate the area from the ground line up to about 2'. Thorough coverage of the area, using enough material to saturate the bark to the point of runoff, is essential. Backpack sprayers with a pressure of 50 to 100 pounds and nozzles producing a solid cone spray work best. Hold the nozzle close to the trunk to avoid waste. Re-spraying may be necessary to complete the kill in the case of sassafras, sumac, elm, and other hard-to-kill species.

Note on Chemical Usage:

Before purchasing any herbicide, read the label to be sure it is intended for the use you have in mind. Make sure the method you are going to use to apply the herbicide is covered on the herbicide label. Disregard recommendations made by store clerks or salespeople if the label does not cover the intended use.

Be sure to use eye protection and rubber gloves when applying herbicide. Follow the manufacturer's recommendations and precautions when using chemicals, and avoid mixing chemicals in amounts greater than what can be used in one day. It is recommended that anyone working with herbicides carry a bottle of eye wash in case of emergencies.

Pruning

Most desirable timber species, such as tulip tree, lose their branches naturally when grown in well-stocked stands. Limit pruning to young, well-formed, valuable trees such as black walnut, black cherry, ash and oak. Not all trees in a plantation or forest need to be pruned, because not all trees live to maturity.

Branches should be pruned before they reach 2" in diameter. Do not prune limbs larger than 4" in diameter. The larger the branch stub, the longer it takes to heal. In addition, larger wounds are more open to disease and insect pest infestation.

The ultimate goal of pruning is to produce a knot-free log at least 16' long. Normally, additional pruning will be necessary after the initial pruning. As a guideline, do not remove more than one-third of the live crown in pruning at any one time. With young trees less than 40' tall, maintain half the tree height in live crown.

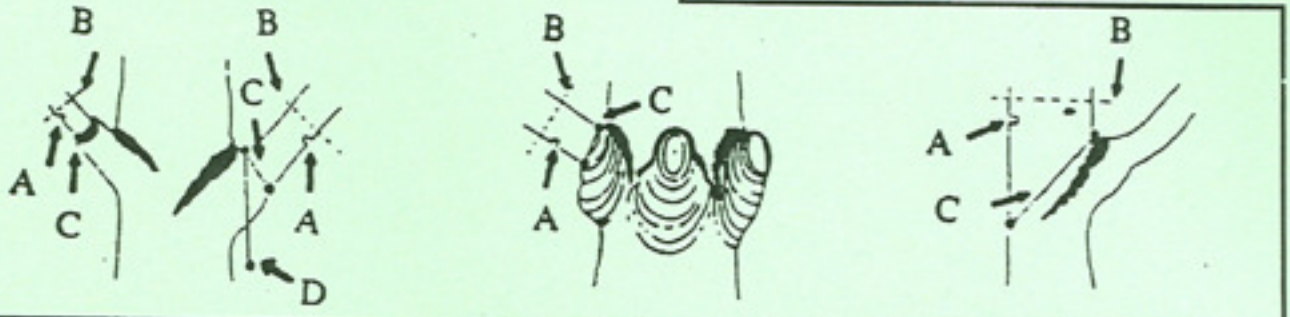
Proper Pruning Technique

A. First cut is made to prevent bark from pulling away when limb is cut.

B. Second cut is made to remove most of the limb.

C. Third cut is made just beyond the branch collar.

D. **Do not cut into the branch collar!**



Regeneration Openings

When a harvest is done in stands where trees are mature, over mature, or contain inferior species, any remaining, scattered trees may not develop into merchantable stock. Many are damaged, hollow or of low value. In this case, openings created by the harvest should be completed before the next growing season. Waiting too long means undesirable regeneration will become well established. Forest improvement efforts made after this time may be ineffective.

Most tree species with high timber value are sun-loving species. These species include white and red oaks, black walnut, white and green ash, black cherry and tulip tree. The seeds and sprouts of these species usually require direct sunlight. Openings in the upper level of leaves, or canopy, will allow direct sunlight to reach the forest floor.

The diameter of these openings should equal at least two times the height of the surrounding trees. For example, if surrounding trees are 80' tall, the woods opening should be at least 160' in diameter. This allows adequate light to reach the forest floor. In such openings, deaden all trees at least two inches in diameter and/or more than 10' tall. Large trees may be harvested for timber and firewood. Treat stumps of undesirable species with herbicide to stop sprouting. Do not treat stumps of desirable species with herbicide. These stumps may sprout new stems that might become future crop trees.

Cost Share Programs

A variety of federal cost share programs are available to help the landowner manage costs while managing woodlands. For further information, contact your district forester, your county's Consolidated Farm Services Agency (formerly ASCS), or a consulting forester.

Consulting Foresters

Consulting Foresters are professionally trained in forest management, and their services are available on a fee or contract basis. Contact the Indiana Forestry & Woodland Owners Association, or your district forester, for a list of consultant foresters.

Forest improvement is an investment of both time and money. As with any land management, the decision to undertake forest improvement must be made carefully. Assistance is available from sources listed at the front of this handbook.

Forest improvement can shape the future of your woodlands. You can care for all natural resources, including timber, wildlife, water, soils and air, by managing your forests properly.